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PROJECT SEEK SCREEN

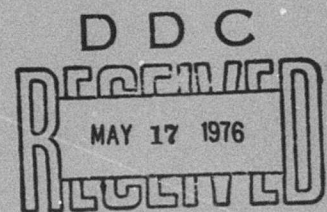
TACS Communication Equipment

Jack A. Mineo

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for use within TACS will also be included to evaluate their ECCM capabilities. The equipments chosen are outlined in the report. They are described in the data sheets by nomenclature and subdivided into navigation and communication headings.

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# TABLE OF CONTENTS

	Page
I. INTRODUCTION . . . . .	1
FIGURE 1. Equipment Selection . . . . .	2
FIGURE 3. TAC Ground Radio Equipment (Ground-Based) . . . . .	4
II. COMMUNICATIONS EQUIPMENTS . . . . .	1
A. Ground-Based Equipments . . . . .	1
1. HF Equipments . . . . .	1
a. AN/TSC-60V (1, 2, 3) . . . . .	1
b. AN/PRC-47 (AN/PRC-104) . . . . .	7
c. AN/GRC-106 . . . . .	9
d. AN/TSC-15 . . . . .	10
e. 718F-2 . . . . .	12
2. VHF/AM Equipments . . . . .	13
3. VHF/FM Equipments . . . . .	13
a. AN/PRC-25 (AN/PRC-77) . . . . .	13
4. UHF/AM Equipments . . . . .	14
a. AN/TRC-87/87A . . . . .	14
AN/GRC-171 . . . . .	16
AN/GRT-22 . . . . .	16
AN/GRR-24 . . . . .	17
b. AN/PRC-41 (AN/PRC-66) . . . . .	18
c. AN/ARC-51BX . . . . .	20
d. AN/ARC-116 . . . . .	20
e. 718M . . . . .	21
5. Wideband Relay Equipments . . . . .	22
a. Troposcatter - AN/TRC-97A . . . . .	22
b. Microwave Relay - AN/GRC-199 . . . . .	23
c. Satellite Relay . . . . .	25
B. Airborne Equipments . . . . .	25
1. HF Equipments . . . . .	25



# TABLE OF CONTENTS (Cont' d)

	Page
a. AN/ARC-123 . . . . .	25
b. 618T HF Transceiver . . . . .	27
2. VHF/AM Equipment . . . . .	29
a. 807A . . . . .	29
3. VHF/FM Equipment . . . . .	29
a. FM 622A . . . . .	29
4. UHF/AM Equipments . . . . .	30
a. AN/ARC-51BX . . . . .	30
b. AN/ARC-34C . . . . .	30
c. AN/ARC-109 . . . . .	31
d. AN/ARC-164 . . . . .	31
e. AN/ARC-171 . . . . .	32
5. Communication Systems Equipments . . . . .	33
a. AN/TSC-53 . . . . .	33
b. AN/MRC-107 . . . . .	33
c. AN/MRC-108 . . . . .	34
III. NAVIGATION EQUIPMENTS . . . . .	34
A. IFF Equipments . . . . .	34
1. General Description . . . . .	34
2. AN/UPX-23 . . . . .	35
3. AN/APX-64/APX-72 . . . . .	36
B. TACAN Equipments . . . . .	37
1. General Description . . . . .	37
2. Ground Station AN/TRN-26 . . . . .	37
3. Airborne Station AN/ARN-21C . . . . .	39

## TABLE OF CONTENTS (Cont' d)

	Page
4. Future Airborne Transmitter . . . . .	39
5. Future Airborne Receiver . . . . .	40
C. LORAN D Equipments. . . . .	40
1. Description . . . . .	41
2. Transmitter . . . . .	41
3. Receiver . . . . .	42

## I. INTRODUCTION.

The communication and navigation radio equipments examined by the study are limited to a representative class of radio equipments which are now directly chargeable to the AN-407L/485L systems and encompass the various data/voice transfer modes. These radio sets are used to generate an ECM vulnerability baseline through which short and long-term ECCM can be accomplished. Any known (new or replacement) equipments or systems envisioned or now in planning for use within TACS are also included to evaluate their ECCM capabilities.

The equipments chosen are outlined in Figures 1 and 2 in terms of the function they serve within TACS. The typical locations of the present inventory equipments within TACS are outlined in Figure 3. The description and capabilities of these equipments are described in the following data sheets by nomenclature and subdivided into navigation and communication categories.

## II. COMMUNICATIONS EQUIPMENTS

### A. Ground-Based Equipments.

#### 1. HF Equipments

##### a. AN/TSC-60V.

The AN/TSC-60 ( $V_1$ ,  $V_2$ , &  $V_3$ ) is a family of 1-kw, 2.5-kw and 10-kw communication central. Each central consists of two complete radio sets (transmitters and receivers).

Orthogonal antennas are designed to satisfy a 0 - to 300 - mile range. The log periodic antenna is designed for worldwide communication; its usable frequency depends on LUF and MUF.

- ( $V_1$ ) - Tactical Control Center (TAC) - 1  
Tactical Air Base (TAB) - 1  
Control Reporting Post (CRP) - 1  
Direct Air Support Center (DASC) - 1
- ( $V_2$ ) - Tactical Air Base (TAB) - 1 & 2  
Air Force Command Control Center (AFCCP) - 2
- ( $V_3$ ) - Tactical Air Base (TAB) - 1  
Air Force Command Control Center (AFCCP) - 2

#### (1) Transmitter.

RF Bandwidth - 16 KHz at 1 db point

Power Output

# EQUIPMENT SELECTION

<u>FUNCTION</u>	<u>EQUIPMENT</u>	<u>MODE</u>	<u>REQUIREMENT</u>
GROUND-GROUND	AN/TSC-60V(1,2,3)	HF/ISB	Voice/TTY
	AN/PRC-47/104	HF/SSB	Voice/TTY
	AN/PRC-25/77	VHF/FM	Voice
	AN/TRC-97A	Troposcatter	Multi-channel Voice/TTY
	AN/GSQ-119/120	Microwave Relay	Multi-channel Voice & Radar Data
SATELLITE-GROUND	AN/MSC-59	Satellite	Voice and Data Relay
	AN/TSC-85	Satellite	Voice and Data Relay
	AN/TSC-86	Satellite	Voice and Data Relay
AIR-GROUND-AIR	AN/TRC-87	UHF/AM	Voice
	AN/GRC-171	UHF/AM	Voice
	AN/GRR-22	UHF/AM	Voice
	AN/GRT-24	UHF/AM	Voice
	AN/TSC-60V(1,2,3)	HF/ISB	Voice
	AN/PRC-41/66B	HF/ISB	Voice
	AN/PRC-41/66B	UHF/AM	Voice
	AN/W-807A	VHF/AM	Voice
	AN/ARC 51BX	UHF/AM	Voice
	AN/PRC-47/104	HF/SSB	Voice
NAVIGATION	AN/TRN-35	Ground	Navigation
	AN/TRN-36	Loran Transmitter	Navigation
	AN/ARN-92	Airborne	Navigation
	AN/ARN-101	Loran Receiver	Navigation
	AN/APX-64	Airborne Transponder	Identification
	AN/APX-72	Airborne Transponder	Identification

FIGURE 1



<u>FUNCTION</u>	<u>EQUIPMENT</u>	<u>MODE</u>	<u>REQUIREMENT</u>
AIR TO AIR	AN/APX-76	Airborne Interrogator	Identification
	AN/UPX-23	Ground Interrogator	Identification
	AN/UPX-48	Ground Interrogator	Identification
	AN/TRN-26	TACAN	Navigation
	AN/ARC-51BX	UHF/AM	Voice
	AN/ARC-34C	UHF/AM	Voice
	AN/ARC-164	UHF/AM	Voice
	WILCOX 807A	VHF/AM	Voice
	FM 622A	VHF/FM	Voice
	AN/ARC-109	UHF/AM	Voice
NOTE:	AN/ARC-123	HF/SSB	Voice
	AN/ARC-171	UHF/AM	Voice
	HF/SSB -	20 - 29.9999 MHz	
	VHF/AM -	105 - 156 MHz	
	VHF/FM -	30 - 75.95 Mhz	
	UHF/AM -	225 - 399.95 MHz	
	Microwave		
	Relay -	Dual mode 4400 - 5000 MHz	
		7125 - 8400 MHz	
	Transmitter -	4400 - 5000 MHz	

AN/GSQ-119/120 Use same microwave radio - AN/GRC-199

FIGURE 2

# TAC GROUND RADIO EQUIPMENT

(GROUND BASED)

LOCATION	FREQUENCY BAND (GHZ)				X BAND (7. 125-8. 4)
	HF (. 002-. 03)	VHF (. 03-. 075) FM 105 - 156. 0 AM	UHF (. 225-. 399)	C BAND (4. 4-5. 0)	
TACC	TSC-60V	—	TRC 87A	TRC 97A	GSQ 119
CRC	TSC-60V	—	TRC 87A	TRC 97A	GSQ 120A
CRP	TSC-60V	—	TRC 87A	TRC 97A	GSQ 120A
FACP	↔	TSC 53	↔	TRC 97A	GSQ 120B
DASC	↔	MRC 107/108	↔	TRC 97A	GSQ 119
	TSC-60V				
TUOC	↔	MRC 107/108	↔	TRC 97A	GSQ 119/120A
	TSC-60V				
TACP	↔	MRC 107/108	↔		
			PRC 66B		
ASRT	TSC-15	—	ARC 116	TRC 97A	

FIGURE 3

TSC 60 ( $V_1$ ) - 1 KW Peak/Avg	} Into 50-ohm impedance- resistive
TSC 60 ( $V_2$ ) - 2.5 KW Peak/Avg	
TSC 60 ( $V_3$ ) - 10 KW Peak/Avg	

### Antennas

#### (a) AS-2841/TSC 60 (V) 2-29.999 MHz Transmitting.

Two dipoles are in quadrature.

Antennas are isolated from each other by not less than 20 db.

Impedance is 50 ohms nominal, unbalanced line.

Antenna includes its own coupler and control.

Efficiency (includes coupler) is:

50% or greater for 2-12 MHz

70% or greater for 12-14 MHz

90% or greater for 14-29.999 MHz

#### (b) AS-2842/TSC-60(V) Receiving

Two dipoles are in quadrature.

Antennas are isolated from each other by not less than 20 db.

Impedance is 50 ohms.

Each dipole has a ferrite balun transformer.

#### (c) Whip Antennas

Receiving antenna, AS 2459/TSC 60( $V_1$ ), is shelter-mounted, 32 feet long.

Transmitting antenna, AS 2459/TSC60 ( $V_1$ ) with tripod AB-1134, is also 32 feet long. Power handling is 1 KW.

#### (d) Log Periodic OE85/TSC60(V)

The range covered is 2-30 MHz in two bands, 2-4 MHz, and

4-30 MHz.

Coverage is 10 KW Peak/Average.

The polarization is horizontal.

Gain is approximately 12 DB at 30 MHz.

Beamwidth is  $65^{\circ} \pm 10$  at half power points.

Take-off angle is  $90^{\circ}$  at 2 MHz, decreasing monotonically within  $\pm 5^{\circ}$  to  $32^{\circ}$  or less at 30 MHz.

Efficiency at 2-4 MHz is not less than 20%; at 4-30 MHz, not less than 95%.

Transition efficiency from 20% to 95 % occurs between 3.9 and 4.1 MHz.

The sidelobe is down at least 14 db below mainlobe maximum within range of 4-30 MHz.

## (2) Receiver.

RF Bandwidth - Broadband

IF Bandwidth - at 3 db, 2.889 KHz

at 60 db, 3.118 KHz (Form Factor 1.074)

Frequency Band & Tunability - The receiver covers 2-29.999 MHz in 100-Hz increments, and the tuning is automatic.

Receiver Sensitivity - 0.5  $\mu$ v for 10-db S/N ratio; For AM Operation, it is 2  $\mu$ v for 10-db S/N ratio.

Dynamic Range.

Frequency Band & Tunability. The frequency range is 2-29.999 MHz in 100-Hz increments. The tuning is accomplished automatically. The Transmitter will tune to a selected frequency in not more than 15 seconds.

Modulation.

AME - AM equivalent transmission.

CW - continuous wave.



LSB, USB - SSB.

ISB - independent sideband.

ISB (MUX) 4 channels - 2 USB and 2 LSB channels

(3) Special Features.

(a) Simplex or duplex operation is possible.

(b) VOX (voice operated-transmit) and PTT (push-to-talk operation) are possible.

(c) Undesired sideband suppression is at least 55 db below the desired sideband.

(d) Hum noise is at least 60 db below PEP in each 3-KHz bandwidth.

b. AN/PRC-47 (AN/PRC-104)

AN/PRC-47

The AN/PRC-47 is a two-man team pack transceiver for CW or SSB voice communication in the 2.0-11.999 MHz frequency range.

The range limitations fall within the limits of LUF and MUF for the time of day, year, and sun spot activity. Generally, it has 49-percent reliability for ranges up to 40 miles.

The AN/PRC-47 can be used for forward-echelon combat control, guidance of air supply or paratroop drops, long-range reconnaissance missions, front-line administration, or tactical networks. It can be mounted in a jeep for near-echelon or front-line employment.

The transceiver will operate on CW or SSB (upper sideband). An external adapter (700C-1) permits teletypewriter communication.

A replacement for the AN/PRC-47 will be the AN/PRC 104.

(1) Transmitter.

RF Bandwidth - 3.0 KHz.

Power Output - Choice of 20W or 100W PEP.

Frequency Range - 2.0 - 11.999 MHz.

Tunability - 10,000 channels in 1-KHz steps over the range 2.0-

11.999 MHz.

Modulation - voice-modulated in the SSB mode, or FSK with external adapter.

(2) Receiver.

RF Bandwidth

IF Bandwidth. At -6 db, 300-3000 Hz above channel frequency (with response at 1700 Hz above channel frequency as reference). At -60 db, 1000 Hz below channel frequency to 4600 Hz above channel frequency.

Frequency Band - 2.0-11.999 MHz.

Tunability - 10,000 channels in increments of 1000 Hz.

Sensitivity - 2  $\mu$ v for 10 db signal-to-noise ratio.

Dynamic Range

(a) Control over limiting.

(b) Phase Lock Loop Override - None.

(c) System Saturation Level - AVC characteristics, less than 10-db audio output variation for input signals from 5-1,000,000.

(3) Special Features. Source power can be 24-volt vehicular power; or 115-volt, 1-phase, 400-Hz source.

AN/PRC-104 (Planned Replacement)

The AN/PRC-104 is an ultra-lightweight HF manpack transceiver. The weight is under 10 pounds (including battery).

(1) Transmitter

RF bandwidth - Power amplifier is a broadband linear amplifier from 2 - 30 MHz.

RF Power Output - 250 milliwatts. This power excites a linear amplifier that delivers 20 watts PEP RF output.

Antenna - An 8-foot whip; a resonant dipole on the AS-2259 near vertical skywave antenna, automatically tuned with a VSWR not greater than 1.5 to 1.

Frequency Range - controlled by a digital synthesizer; direct readout is on the front panel. The frequency range is 2 to 29.9999 megahertz in 100-Hz steps for a total of 280,000 selectable channels.

Modulation

(a) (USB) (LSB) SSB

(b) Data

(2) Receiver.

RF Bandwidth - Broadband techniques; the spurs, images, and cross modulation are reduced to a minimum by use of passive, wide-dynamic-range first mixer and up-conversion to a high first IF stage.

IF Bandwidth - The only figure available is an image rejection of -70 db.

Frequency Band and Tunability - the same as those for the transmitter.

Receiver Sensitivity - .7 microvolts for 10-db  $\frac{S+N}{N}$  ratio.

c. AN/GRC-106.

The AN/GRC-106 is a 2- to 30- MHz, 400-watt peak-envelope-power, single-sideband transistorized transceiver designed and developed for tactical usage by the U.S. Army. It provides initial long-distance communication when ground forces enter a new area and enables a commander to maintain radio contact with widely dispersed forces in a fluid combat area, even when his vehicle is in motion.

The radio set also provides dependable 50-mile voice communication, even over severe terrain obstructions.

(1) Transmitter.

RF Bandwidth - Final stage is a broadband linear amplifier.

Power Output - SSB - 400-watt PEP (USB)

AM - 400-watt PEP

CW - 200-watt Average

FSK - 200-watt Average

Antenna - A standard doublet-type 15-foot whip. The 15-foot whip has a slight gain over isotropic and is omnidirectional. The doublet antenna has a gain of approximately 2 db over isotropic. The radiating pattern is a figure-

eight, broadside to the antenna.

Frequency Range - 2.0 to 29.999 MHz in increments of 1 KHz.

Modulation - SSB (USB)

AM

CW

FSK (with MD-552( )/GRC

(2) Receiver.

RF Bandwidth - Broadband.

<u>IF Bandwidth</u> - 3 KHz at 6-db points	}	SSB
6.5 KHz at 60-db points		
6 KHz at 6-db points	}	AM
10.8 KHz at 60-db points		

Frequency Range - 2.0 to 29.999 MHz in 1-KHz increments.

Receiver Sensitivity - less than .3 $\mu$ v for 10db S/N ratio.

Dynamic Range.

(3) Special Features.

(a) Interference from pulse-type noise is eliminated by a self-contained noise blanker which does not require the use of a separate noise-sensing antenna.

(b) Automatic tuning is accomplished by broadband techniques.

(c) The AN/GRC-106 can be used with a 2000-watt linear power amplifier, AM-3399/GRC, to provide a full-duplex communication facility in the radio teletypewriter set, AN/GRC-108.

d. AN/TSC-15.

The Communication Central AN/TSC-15 is a multichannel, transportable, shelter-mounted, HF radio system. Three voice channels and four multiplex teletypewriter channels can be transmitted and received simultaneously. Communication capabilities include SSB voice, tone-modulated CW, radio teletypewriter, and compatible AM modes of operation.

(1) Transmitter.

RF Bandwidth - Broadband.



Power Output - 900-watts PEP, 2-15 MHz  
750-watts PEP, 15 - 29.999 MHz  
180-watts AM  
700-watts CW & FSK

Low Power Output - 100- to 300-watts PEP  
40- to 80-watts AM  
100-watts CW & FSK

Antenna - a 32-foot whip.

Vertical polarization.  
Gain of approximately 2 db over isotropic.  
Omni directional range.

Frequency Range - 2.0 to 29.999 MHz, 28,000 channels in 1-KHz steps.

Modulation - AM, FSK.  
SSB - USB & LSB, ISB (independent sideband)  
TSB - twin sideband.

(2) Receiver.

RF Bandwidth.

Band Pass filter, F-508/U.

2-8 MHz - 70 db attenuation at  $\pm 10$  percent of center frequency.

8-12 MHz - 65 db attenuation at  $\pm 10$  percent of center frequency.

12-20 MHz - 60 db attenuation at  $\pm 10$  percent of center frequency.

20-29.999 MHz - 50 db attenuation at  $\pm 10$  percent of center frequency.

IF Bandwidth - SSB - 3.0 KHz at 6-db points.  
5.5 KHz at 60-db points.  
AM - 6.0 KHz at 6-db points.  
10.8 KHz at 55-db points.

Frequency Range - 2.0 - 29.999 MHz; 28,000 selectable channels at 1-KHz increments.

Sensitivity - SSB 3.0  $\mu$ v for 10 db S/N.  
AM 7.5  $\mu$ v for 10 db S/N.

Dynamic Range - Cross modulation is at least 10 db below a desired 2-  $\mu$ V CW signal when an undesired 91-volt peak signal (modulated 30% with 400 Hz) is received at least  $\pm 10\%$  away from the desired signal.

(3) Special Features.

- (a) 28,000 selectable channels.
- (b) One-man operation.
- (c) Simplex and duplex operation.
- (d) Truck or aircraft transport ability.
- (e) Self-contained test set for easy maintenance.
- (f) Only 30-minute set-up time at new installation.

e. 718F-2, HF Radio

This consists of one 718T-3 Transceiver and one 426T-1 Power Converter.

(1) Transmitter.

Power Output - SSB: 400-watts PEP  
AM: 125-watts carrier.  
CW: 125 watts

Channels - 2,000 thru 29.999 MHz.  
28,000 channels in 100-HZ increments

Frequency Stability - .8 parts-per-million per month.

Source Power - 27.5 volts DC, approximately 1150 watts  
115 volts, 400 HZ, 1 phase approximately 1000

watts

Distortion - SSB: Third-order distortion products down at least

30 db.

AM: Less than 20% at 80% modulation with 1000 HZ

RF Output Impedance - 50 ohm.

Antenna - Whip and dipole.

(2) Receiver.

Sensitivity - SSB: 1 microvolt for 10 db STN/N ratio.  
AM: 3 microvolts, modulated 30%, 1000 HZ for 6 db STN/N ratio.

Receiver Selectivity - SSB: 2.85 KHz at 6 db down.  
AM: 5.5 KHz at 6 db down and  
1.40 KHz min. at 60 db down.

AGC Characteristics - Maximum variation of audio output is 6 db for input signals from 10 to 100,000 microvolts. No overload below 1 volt signal output.

IF Rejection - 80 db minimum

Audio Distortion - Less than 10% with 1000 microvolt input modulated 80% at 1000 HZ.

Audio Response - 5 db peak-to-valley ratio from 300-3000 HZ.

Image Rejection - 60 db minimum below desired frequency relative to 5 microvolt input.

## 2. VHF/AM Equipments

See Airborne Data on RT 807A.

## 3. VHF/FM Equipments.

### a. AN/PRC-77 (AN/PRC-25)

Radio Set AN/PRC-77 is a portable man-pack, battery-operated, frequency-modulated (FM) equipment which provides voice communication over a frequency range of 30.00 to 75.95 megahertz. This equipment is also used for vehicular operation. The AN/PRC-77 is fully transistorized and is a replacement for the tube version AN/PRC-25.

#### (1) Transmitter

RF Bandwidth - Broadband

Power Output - 1.5 watts on high band  
2.0 watts on Lo band

Antenna - mounted on the transceiver

- (a) Vertical polarization
- (b) No gain

(c) Omnidirectional.

Frequency Range - 30.00 to 75.95 MHz in 50 KHz increments.

FM Modulation.

(2) Receiver

RF Bandwidth - 20 KHz

IF Bandwidth - 32 KHz - at 6 db points

100 KHz - at 60 db points

120 KHz - at 120 db points

Frequency Range - 30 to 75.95 MHz in 50 KHz increments.

Receiver Sensitivity - .5  $\mu$ v for 10 db S/N ratio.

Dynamic Range.

(3) Special Features

(a) Completely solid state transceiver.

(b) Synthesizer frequency control.

(c) Direct frequency readout on front panel.

#### 4. UHF/AM Equipments.

##### a. AN/TRC-87 /87A

The Radio Set is a two-way 3500-channel UHF communications set housed in a shelter and operated from a remote site. A total of 25 frequencies are available at the remote site.

The purpose of the radio set is to provide two-way ground-to-air voice communications on five simplex voice channels from remote operating positions and from 1 auto-tune and 5 fix-tune radios.

The equipment can be transported by truck, air cargo transport, or helicopter lift.

(1) Transmitter.

RF Bandwidth - Modulation 200 - 4000 Hz.



Power Output - RF carrier 100 watts min.

RF carrier modulated - 360 watts peak.

Antenna - AT-197/GR discone UHF configuration with about .3 db gain. It is omnidirectional, vertically polarized.

Frequency Range - from 225 - 399.95 MHz. Servo drive system allows selection of 21 pre-set channels covering any of 3500 channels.

Modulation - AM.

(2) Receiver.

RF Bandwidth - provided in IF stage.

IF Bandwidth - at 6 db points - 40 KHz.

Tunability - same as for transmitter.

Receiver Sensitivity -  $3 \mu\text{v}$  30% modulated at 1000 Hz minimum.

Tuning - Due to the close proximity of equipment, the four manual operating channels must be tuned to frequencies that are separated a minimum of 5 megahertz. A 2-megahertz spacing is satisfactory between the automatic channel and each of the four manual channels.

(3) Special Comments.

The AN/TRC-87A is a modified AN/TRC-87 which provides a broader audio passband (the 87 audio passband is 200-4000 Hz).

(4) Special Features.

(a) Transmitter.

RF Bandwidth - 5 MHz/Radio

Power - 100 watts carrier  
360 watts peak at 90% modulation

(b) Receiver.

RF Bandwidth - 5 MHz/Radio

IF Bandwidth - 6 db points greater than 40 KHz  
60 db points less than 150 KHz

(5) AN/GRC-171 Transceiver.

The AN/GRC-171 UHF transceiver is designed for air traffic control communication at collocated VHF/UHF transmitter/receiver sites. The equipment is completely solid state, providing AM communications on any one of 7000 channels in the 225 - 399.975 MHz band.

(a) Transmitter.

RF Bandwidth - Broadband Linear Amp

Power Output - 20 watts

Antenna - 24 db isolation in collocated areas recommended.

Frequency Range - 225 - 399.975 MHz, 7000 channels, 25 KHz separation.

AM Modulation.

(b) Receiver.

RF Bandwidth - Broadband

IF Bandwidth - 50 KHz Radio - 6 db points  $\pm 18$  KHz  
25 KHz Radio - 6 db points  $\pm 10$  KHz

Frequency Range - 225 - 399.975 MHz, 7000 channels, 25 KHz spacing.

Receiver Sensitivity - Not less than 8 db  $(\frac{S+N}{N})$  at 3  $\mu$ v with 24 db isolation between antennas and 7 MHz frequency separation between transmitters - or not more than 2 db  $(\frac{S+N}{N})$  degradation under these conditions.

Desensitization - No more than 2 db audio reduction for undesired signal of 100,000  $\mu$ v at 0.9 MHz.

(This radio set is a direct replacement for the AN/ARC-27, AN/ARC-34, AN/ARC-51X/BX, AN/ARC-70, and AN/ARC-109V.)

(6) AN/GRT-22 Transmitter

This single-channel transmitter is used for worldwide deployment in the air traffic control service and operates on any of 3500 channels allocated in this service between 225 and 399.95 MHz.

RF Bandwidth - Wide bandwidth data modulation over 300 Hz and 34,000 Hz shall not change by more than +1 or -2db from a reference of 1000 Hz; modulation is 90%  $\pm 10\%$  with input signal of 0 dbm at 1000 Hz:

Power Output - Exciter, 10 watts.

Linear Amp, 50 watts.

Antenna - To be assigned as a function of A/C.

Frequency - controlled by crystal or external precision variable oscillator.

AM modulation.

(7) AN/GRR-24 Receiver.

This single-channel receiver is used for worldwide deployment in the air traffic control service and operates on any of the 3500 channels allocated to this service between 225 and 399.95 MHz.

RF Bandwidth - Broadband.

IF Bandwidth - for 50 KHz channel spacing,

at 6 db points -  $\pm 18$  KHz min.

20 db points -  $\pm 27$  KHz min.

40 db points -  $\pm 31$  KHz min.

60 db points -  $\pm 35$  KHz min.

80 db points -  $\pm 40$  KHz min.

IF Bandwidth - for 25 KHz channel spacing,

at 6 db points -  $\pm 9$  KHz min.

20 db points -  $\pm 14$  KHz min.

40 db points -  $\pm 15$  KHz min.

60 db points -  $\pm 16$  KHz min.

80 db points -  $\pm 20$  KHz min.

Data Capability - Exchange of normally supplied IF selectivity, determining modules with suitable wide bandwidth selectivity modules having a maximum bandwidth of 75 KHz above and below the IF center frequency.

Frequency - The receiver incorporates a crystal oscillator having a frequency accuracy of  $\pm 0.001\%$ .

Also, an external precision oscillator is available for frequency control in lieu of the crystal.

Sensitivity - two receivers operated from one antenna.

With the inputs of two receivers connected in parallel on a single antenna, and the receivers tuned to channels separated by 3 MHz, a signal of 4  $\mu$ v modulated 30% on each channel shall produce a signal 10 db  $\frac{S+N}{N}$  ratio

while delivering 100 milliwatts of audio power at each receiver output.

Desensitization - With a standard signal of 3  $\mu$ v modulated 30% applied to the receiver and audio output control adjusted for 100 milliwatts, the following high-level off channel unmodulated signals shall not reduce a receiver output of more than 2 db.

Undesired Sig. Level dbm	Freq. $\pm$ MHz
- 10	1.5
0	2.6
+ 10	4.5
+ 20	6.0

b. AN/PRC-41 (AN/PRC-66B)

The AN/PRC-66B is a small portable transceiver which provides effective AM communication on the UHF band (225 - 400 MHz). It is intended for use by the forward air controller for ground-to-air communications.

(1) Transmitter

RF Bandwidth - Broadband

Power Output - 2 watts

Antenna - a flexible fixed length mounted on the transceiver

- (a) Vertical polarization.
- (b) Gain over isotropic in 2 db approximately.
- (c) Sidelobe structure not applicable.
- (d) The radiation is omnidirectional.

Frequency Range - 225 - 400 MHz in 50 KHz increments, and 3500 channels are available over the range.

Modulation - AM.

(2) Receiver.

RF Bandwidth - Broadband

IF Bandwidth - 44 KHz at the 6 db points.

Frequencies - selected by four switches that preset the selected frequency. Direct readout of the selected frequency is on the front panel.

Sensitivity -  $\mu$ v for 10 db S/N ratio.



Dynamic Range.

- (a) Control over limiting.
- (b) Phase lock loop over ride.
- (c) System saturation level.

(3) Special Features.

- (a) Frequency synthesizer control.
- (b) Replaces AN/PRC-41 in inventory.

AN/PRC-41 (SUPERSEDED BY AN/PRC-66, described above).

The AN/PRC-41 is a Marine Corps tactical UHF transceiver used for Forward Air Control. It covers 225 - 399.0 MHz frequency range. This man-pack transceiver can be used for fixed locations or in a vehicle.

(1) Transmitter

RF Bandwidth - Broadband

Power Output - 3 watts

Antenna - For man-pack and vehicular application, the antenna is a ground-plane vertical; it is omnidirectional with vertical polarization. In fixed locations, the antenna can be a UHF log periodic.

Frequency - The transceiver covers a frequency range of 225 - 399 MHz in 100 KHz steps.

Modulation - A. M.

(2) Receiver.

RF Bandwidth - Broadband.

IF Bandwidth - 47 KHz at 6 db

Frequency Range and Tunability - same as the transmitter.

Receiver sensitivity - 3 microvolts for 10 db  $\frac{S+N}{N}$  ratio.

Dynamic Range - No information.

(3) Special Feature.

Transceiver will function as relay.

c. AN/ARC-51BX

Radio Set AN/ARC-51BX is an airborne UHF transceiver that provides complete air-to-air or air-to-surface communication on 1750 crystal-controlled channels in the 225.0- to 399.9-MHz frequency range.

The AN/ARC-51BX consists of RECEIVER-TRANSMITTER RT-742/ARC-51BX, Indicator 1D-1003/ARC, Blower HD-615/ARC-BX.

(1) Transmitter.

RF Bandwidth - Broadband final P. A.

Power Output - 20 watts.

Antenna - Aircraft-type antenna, omnidirectional. The Radio Set Control Unit allows the selection of any one of 3500 channels - frequency separation is 50 KHz. Range 225 - 399.95 MHz.

Modulation - A. M. voice.

(2) Receiver.

RF Bandwidth - Broadband

IF Bandwidth -

6 db points - 47 KHz

60 db points - 85 KHz

Selectable on control unit, 3500 channels, 50 KHz spacing - direct readout.

Sensitivity - 4.0 for 10 db  $\frac{S+N}{N}$  ratio.

d. AN/ARC-116

The AN/ARC-116 is an airborne UHF transceiver covering a frequency range of 225.0 to 399.95 MHz. It is all solid-state designed originally for application in the OH-6A Light Observation Helicopter. When this equipment is used with the ARA-25 or ARA-50 ancillary equipment, it can be used for direction finding.

(1) Transmitter.

RF Bandwidth - Broad band amplifier.

Power output - 10 watts

Antenna - aircraft type which is omnidirectional.

Frequency - 225 to 399.95 MHz and is tuned to any frequency in 50 KHz steps. The tuning is fully digitalized using an indirect synthesizer. Frequency change is accomplished in less than 50 milliseconds.

Modulation - A. M.

(2) Receiver.

RF Bandwidth - Broadband.

IF Bandwidth - at 6 db points - 30 KHz.

Tuning - identical to transmitter tuning.

Sensitivity - 4 microvolts for 10 db  $\frac{S+N}{N}$  (input 30% mod.; one KHz).

(3) Special Features.

(a) Digital data transmission.

(b) Homing/DF.

(c) Separate guard receiver.

e. 718M-2

This Radio Set consists of the following: 618M-1C VHF transceiver in the 116.00 to 149.975 MHz band, 1360 channels spaced 25KHz spacing; and RT 742/ARC 51 BX UHF Receiver-Transmitter in the 225.0 to 399.95 MHz band, 3500 channels spaced 50 KHz.

Both of the units are housed in a 718-M2 waterproof case. The units are operated remotely by Control Units 313V-3 and 313V-4.

The Radio Set can be used in airborne installations as well as in mobile installations such as the AN/MRC-108.

(1) Transmitter (618M-1C)

RF Bandwidth - Broadband amplifier

Power Output - 30 watts nominal

Antenna - Because of the extended frequency range capability, the 618M-1C model may be used only with the Collins 37R-2 antenna. The antenna

is an airborne configuration. The antenna is omnidirectional, vertically polarized.

Tuning - accomplished by the digital binary information supplied from the remote control unit to the Collins autopositioner.

Modulation - A. M.

(2) Receiver.

RF Bandwidth - Broadband 116-150 MHz.

IF Bandwidth - at 500 KHz

Normal filter 6 db points 40 KHz

60 db points 68 KHz

Sharp filter 6 db points 20 KHz

60 db points 32 KHz

Tuning - the same as for selection of operating frequency using the remote control unit.

Sensitivity -  $\mu\text{v}$  for 10 db  $\frac{S+N}{N}$  ratio.

5. Wideband Relay Equipments

a. Troposcatter AN/TRC-97A

Radio Set AN/TRC-97 is a type nomenclature that covers a series of tactical troposcatter radio sets. The basic radio set design was accomplished in 1963 - 1964. Production quantities of the various versions have been procured over the intervening years to 1974 from three different manufacturers. The USAF inventory contains only AN/TRC-97A and AN/TRC-97D versions which total approximately 300 units. The differences between these two radio sets are mostly in mechanical design and not in the electronic design or system performance parameters.

Radio Sets AN/TRC-97 in the USAF inventory operate in the 4400- to 5000-MHz frequency range with 500-KHz incremental tuning. The transmitted power output is 1 kilowatt radiated in an 8-foot-diameter parabolic antenna. The radio set is frequency modulated and uses frequency-division multiplexing to provide duplex 24-voice channel capability to 100 miles. A second 8-foot-diameter parabolic antenna is provided for dual space diversity reception. The dual receivers have a nominal 5-db noise figure with tunnel diode preamplifiers. Their output is summed using a maximal ratio post detection combiner. The receiver IF frequency is at 70 MHz and has a maximum bandwidth capability of 20 MHz followed by a 2-MHz bandwidth filter. A line-of-sight microwave capability can also be obtained. This is accomplished by bypassing the power amplifier and transmitting the 1-watt exciter output into the 8-foot paraboloid whose center line is 15 feet above ground level.



The receiver IF filter may be removed to obtain the 20-MHz bandwidth capability.

The AN/TRC-97 system is transported by a truck-mounted S-308-type shelter and an M-101-type trailer. The shelter contains the basic radio equipment while the trailer contains the EMU-12 motor generator set and the antenna group. Total system weight of the shelter and trailer contents is about 3600 pounds.

Frequency - 4.4 - 5.0 GHz - Tunable in 500 KHz increments.

Antenna - 8 Ft Parabolic Dish

Sidelobes  $\pm 14^\circ$  - 20 db down  
 $\pm 14^\circ$  -  $\pm 30^\circ$  - 20 db down  
All others - 39 db down

Polarization - Vertical or Horizontal.

Gain - 38 db.

Mounted on 15' Mast - two antennas for dual-space diversity.

Transmitter - Bandwidth

TROPO Mode - 1.5 MHz

LOS Mode - 20 MHz

Power

TROPO Mode - 1 KW

LOS Mode - 1 watt

Modulation - F.M.

Receiver - IF Bandwidth

TROPO Mode - 1.5 MHz (3 db)

LOS - 20 MHz

Sensitivity - -105 dbm

(Noise figure)  $N_f = 5.3$  db

b. Microwave Relay AN/GRC-199, P/O AN/GSQ-119 and AN/GSQ-120.

Radio Set AN/GRC-199 is a microwave line-of-sight equipment designed to operate over 15-nautical-mile paths in the 4.4- to 5.0-GHz or 7.125- to 8.4-GHz band. The radio set is FM modulated with a peak deviation of 5 MHz and has an output power of 500 mw. The antenna provided is a 6-foot parabola. The receiver has a 30-MHz IF bandwidth.

In the 4.4- to 5.0-GHz band, the radio set is tunable in 100-KHz increments. The receiver has a 6.9-db noise figure. The diplexer insertion loss is 3.5 db on the transmit side and 2.3 db on the receive. The antenna gain is 36 db with a tower height of 80 feet in 20-foot increments. Transmission line loss is 1.5 db. In the 7.125- to 8.4-GHz band, the radio set is tunable in 1-MHz increments. The receiver noise figure is 9.7 db. The diplexer insertion loss is 4.5 db on transmit and 2.9 db on receive. The antenna gain is 40 db and a tower height of 60 feet is provided. Transmission line loss is 2.1 db.

The radio set when used in the AN/GSQ-119 is provided with FDM multiplexers and designed for a 40-db fade margin. When used in the AN/GSQ-120, it is provided with radar remoting multiplexers and has a 30-db fade margin due to the wider IF bandwidths involved.

The overall system is packaged in an S-141 type shelter and its weight is about 3500 pounds.

#### (1) Equipment Characteristics

Frequency - 4.4 - 5.0 GHz/7.125 - 8.4 GHz  
RF Selection - 100 KHz/ MHz

Antenna - 6 Foot Parabolic  
Plane Polarization (Vert. or Horiz.)  
Gain 36 db/40 db

Transmitter - Power Output - 900 MW  
Baseband Bandwidth - 30 Hz - 10 MHz (3db)  
Modulation - FM  
Pre/De-Emphasis

Receiver - Receiver IF Bandwidth - 30 MHz (3 db)  
Noise Figure 6.9 db/9.7 db  
Receiver Sensitivity - -92.33 dbm/ -89.53 dbm

Fade Margin - 15 NM  
Design Range - 39 db/38 db

(2) Special Features - This equipment with the dual RF head feature has an inherent ECCM capability since the jammers need to cover both frequency bands.

### **c. Satellite Relay.**

A family of tactical communications terminals is being developed specifically for military use with the Defense Satellite Communication System Phase II Satellite (DSCS-II). These terminals will augment current communications means and provide quick reaction capability needed to support tactical missions of the future. All terminals transmit in the 7.9- to 8.4-GHz band and receive in the 7.25 - 7.75 GHz band, and all include automatic tracking 8-foot-diameter antennas.

The AN/MS-59 terminal is the smallest of the family and is mounted in a modified M-569 jeep trailer. The terminal consists of a complete radio set and antenna group as well as the necessary PCM multiplexing equipment to provide transmission and reception of 6 or 12 voice channels.

The AN/TSC-85 terminal is mounted in a 1-1/4 ton truck to be used for multipoint operation in tactical trunking systems. The terminal is intended for medium or high capacity voice, data and teletype traffic on a point-to-point basis (e. g. 6, 12 or 24 channel PCM voice channels).

The AN/TSC-86 is the largest and most sophisticated of the terminals. This terminal is mounted in a 2-1/2 ton truck with fully redundant radio sets and a single antenna system.

In operation, this terminal will provide point-to-point operation on an IF-IF basis. Further, a beacon receiver is included for antenna tracking signals whereas the smaller terminals derive their tracking signals from the communications channel itself.

### **B. Airborne Equipments**

#### **1. HF Equipments.**

##### **a. AN/ARC-123**

This is an airborne HF Transceiver with some very modern features such as:

Wide dynamic range - 120 db rejection of interfering signals.

Built-in test indicator.

Electronic tuning.

Solid state design with redundant amplifier stages.

Noise-blanking circuitry which eliminates the effect of impulse type interference.

TRANSMITTER	AN/MSC-59	AN/TSC-85	AN/TSC-86
A. RF Bandwidth (Instantaneous)	500 MHz	40 MHz	40 MHz
B. Power Output	100 Watts	500 Watts	1 KW
C. Antenna Description	8' Parabolic	8' Parabolic	8' Parabolic
1. Polarization	Circular	Circular	Circular
2. Gain	44 db	44 db	44 db
3. Side Lobe Structure	Not Available at this time.	Not Available at this time.	Not Available at this time.
4. Beamwidth (3 db)	1°	1°	1°
D. Frequency Band	7.9 - 8.4 GHz	7.9 - 8.4 GHz	7.9 - 8.4 GHz
1. Tunability	1 MHz Steps	1 MHz Steps	1 KHz Steps
E. Modulation	BPSK	BPSK	All Compatible Modems

RECEIVER	AN/MSC-59	AN/TSC-85	AN/TSC-86
A. RF Bandwidth	500 MHz	500 MHz	500 MHz
B. IF Bandwidth	40 MHz	40 MHz	40 MHz
C. Frequency Band (RF)	7.25-7.75 GHz	7.25-7.75 GHz	7.25-7.75 GHz
1. Tunability	1 MHz Steps	1 MHz Steps	1 KHz Steps
D. Receive G/T	18.3 db	18.3 db	18.3 db
E. Gain Compression (LNA 0.5 db)	-60 dbm	-60 dbm	-60 dbm
1. Down Converter (1 db)	-25 dbm	-25 dbm	-35 dbm



(1) Transmitter.

RF Bandwidth - Broadband linear amplifier.

Power Output -

SSB - 400 watts PEP

FSK - 200 watts average

AM - 125 watts carrier

Transceiver - covers the frequency range of 2.0000 to 29.9999 MHz in 100 Hz steps. The tuning is performed electronically, and the tuning time is 2 seconds.

Modulation -

(1) SSB (USB)

(2) FSK

(3) A. M.

(2) Receiver.

R. F. Bandwidth - not given; however, selectivity is designed in the IF stages.

I. F. Bandwidth -

SSB - at 6 db points - 3.1 KHz minimum  
at 60 db points - 4.5 KHz maximum

AM - at 3 db points - 3 KHz minimum  
60 db points - 5.8 KHz maximum

Tunability - the same as the transmitter information.

Sensitivity - .5  $\mu$ v for 10 db  $\frac{S+N}{N}$  ratio in SSB. 1.5  $\mu$ v modulated 30% at 100 Hertz for 6 db  $\frac{S+N}{N}$  ratio.

Dynamic range - 120 db

b. 618T HF Transceiver.

(1) Transmitter.

Power Out - SSB - 400 W PEP

Impedance - AM - 125 watt

RF - 50 ohm

Audio Response -5 db peak-to-valley

Distortion - SSB 3rd order

Products Dwn 30 db

AM - less than 20% at 85% mod.

Number of Channels - 28,000

Spacing - 100 KHz

Frequency Stability - 0.8 parts/10<sup>6</sup>/month

Frequency Control Auto - Position type remotely controlled switching mechanism.

(2) Receiver.

Sensitivity -

SSB - 1 $\mu$ v for 10 db  $\frac{S+N}{N}$

AM - 3 $\mu$ v 30% mod at 1,000 Hz for a 6 db  $\frac{S+N}{N}$

Selectivity -

SSB - 2.85 KHz 6 db down

6.0 KHz 60 db down

AM - 5.5 KHz 6 db down

1.4 KHz 60 db down

IF Rejection - 80 db min.

Audio Out - 100 mw into 300 ohm

Audio Distortion - 10%

Audio Response - 5 db peak to valley fm 300 - 3,000 Hz

NOTE: 718M-2 HF TRANSCEIVER

Frequency control by computer or control box, otherwise same as 618T(HF)

## 2. VHF/AM Equipment.

### a. 807A.

The Radio Set 807A is an airborne VHF/AM transceiver that transmits and receives voice communication in the frequency range of 116.000-through 149.975-MHz. The Radio Set is used by the Air Traffic Control Signaling System (ATCSS).

#### (1) Transmitter.

RF Bandwidth - Broadband amplifier.

Power Output - 40 watts nominal.

Antenna - requires the Collins 37R-2 or the Transco 23070-5 antenna. These antennas are omnidirectional.

VHF Bandwidth - operates in the VHF band from 116.000 to 149.975 MHz in 25 KHz steps.

Modulation - AM.

#### (2) Receiver.

RF Bandwidth of front end is unknown.

IF Bandwidth at 6 db points  $\pm$  6 KHz  
60 db points  $\pm$  18 KHz

Frequency - covers the same frequency range as the transmitter.

Sensitivity - 3  $\mu$ v for a 6-db signal plus noise-to-noise ratio.

## 3. VHF/FM Equipment.

### a. FM 622A.

This radio set is an airborne VHF-FM radio that is the airborne version of the Army ground radio set AN/VRC-12. It is capable of operating as a relay unit for retransmission of clear voice and homing information.

#### (1) Transmitter.

RF Bandwidth - Broadband.

Power Output - 10 watts at 27.5 VDC.

Antenna - aircraft type - Magnavox, part number 709226-801, with coupler type 709151-801.

Tuning - performed by bandswitching and varactor tuning over the frequency range of 30 to 75.95 megahertz in 50 KHz steps. Total number of channels is 920.

Modulation - FM.

Frequency Deviation - 8  $\pm$  2 KHz nominal; can deviate to 20 KHz.

(2) Receiver.

RF Bandwidth - provided in IF stage.

I. F. Bandwidth - at 6 db points - 32 KHz min.  
at 60 db points - 85 KHz min.

Tunability - same as transmitter.

Sensitivity - .4  $\mu$ v for 10 db  $\frac{S+N}{N}$  ratio.

Dynamic range - Limiting characteristics, less than 1-db change in audio output from one to 100,000 microvolts.

4. UHF/AM Equipments

a. AN/ARC-51BX (Refer to paragraph II. A. 4. c.)

b. AN/ARC-34C

The AN/ARC-34 is an airborne UHF Transceiver covering the frequency range of 225 - 399.95 MHz.

(1) Transmitter.

RF Bandwidth - Broadband

Power Output - 80 - 15 Watts

Antenna - airframe mounted. Polarization is vertical.

Frequency Range - 225 - 399.95 MHz, spaced in 50-KHz steps.  
There are 20 preset channels plus one guard frequency.

Modulation - AM.

(2) Receiver.



RF Bandwidth - Broadband.

IF Bandwidth - Normal 60 KHz at 6 db points.

Frequency Range and Tunability - the same as the transmitter.

Sensitivity - 5 microvolts for 10 db  $\frac{S+N}{B}$  ratio.

Dynamic Range - no information.

c. AN/ARC-109.

The AN/ARC-109 is an airborne UHF Transceiver covering the frequency range of 225 - 399.95 MHz.

(1) Transmitter.

RF Bandwidth - Broadband

Power Output - 30 watts A. M.

Antenna - mounted on aircraft and has vertical polarization.

Frequency Range - 225 - 399.95 MHz in 50-KHz steps. Twenty preset channels are available plus one guard channel.

Modulation - AM.

(2) Receiver.

RF Bandwidth - Broadband

IF Bandwidth - 80 KHz at 6 db points.

Frequency Range and Tunability - the same as transmitter.

Receiver Sensitivity - 3 microvolts for 10 db  $\frac{S+N}{N}$  ratio.

Dynamic Range - no information

(3) Special Features.

(a) Will function on A. M. using wideband secure voice.

(b) It will operate as automatic relay.

d. AN/ARC-164.

This Transceiver is a UHF Radio Set which serves as a replacement for existing AN/ARC-34, AN/ARC-27 and AN/ARC-51 sets or as the originally installed radio in new aircraft.

(1) Transmitter.

RF Bandwidth - Broadband

Power Output - 10 watts A. M.

Antenna - Aircraft mounted, vertically polarized.

Frequency Range - 225 - 399.975 MHz tuned in steps of 25 KHz or 50 KHz. It has 20 preset frequencies plus one guard channel.

Modulation - AM.

(2) Receiver.

RF Bandwidth - Broadband

IF Bandwidth - Normal - 16 KHz at 6 db points  
Broad - 70 KHz at 6 db points

Tunability - the same as transmitter.

Sensitivity - 4 microvolts for 10 db  $\frac{S+N}{N}$  ratio.

Dynamic Range - No information.

(3) Special Feature.

Compatible with Vinson KY-28.

e. AN/ARC-171.

The AN/ARC-171 is an airborne UHF Transceiver covering the frequency range of 225 - 399.975 MHz.

(1) Transmitter.

RF Bandwidth - Broadband

Power Output - 30 watts A. M. , 100 watts F. M.

Antenna - mounted on the aircraft and has vertical polarization.

Frequency Range - 225 - 399.975 MHz, and each channel is spaced 25 KHz. Twenty preset channels are available plus one guard channel.

Modulation - A. M. and F. M.

(2) Receiver.

RF Bandwidth - Broadband.

IF Bandwidth - 16 KHz at 6 db points, normal.  
70 KHz at 6 db points, wideband.  
ECCM MODEM 10 MHz BW.

Frequency Band and Tunability - same as transmitter.

Receiver Sensitivity - 4 microvolts for 10 db  $\frac{S+N}{N}$  ratio on A. M.  
Also 4 microvolts for 20 db  $\frac{S+N}{N}$  ratio on F. M.

Dynamic Range - no information.

(3) Special Features.

- (a) Compatible with wideband secure voice.
- (b) Compatible with TADIL A (link 11) F. M.
- (c) Compatible with TADIL C (link 4) FSK.
- (d) Will function as automatic relay.

5. Communication Systems Equipments

a. AN/TSC-53.

Includes:

- 2 - R+ 807
- 1 - GRC-157
- 1 - GRC-106
- 2 - ARC 51/BX

b. AN/MRC-107.

Jeep configuration using AN/GRC-106.

VHF-FM SYSTEM using AN/GRC-125

Frequency Range - 30.00-75.95 MC

Channels - 920

Preset Channels - 2

Power Out - 1.5W

Audio Frequency Response - 300-3000cps

also includes:

AN/PRC-47

AN/PRC-41

AN/ARC-51BX (T. M. 11-5820-518-35)  
(T. O. 12R2-2ARC51-12)

WILCOX 807 VHF AM

Used at TACP and DASC

c. AN/MRC-108

Consisting of:

1. HF TCVR/XMITTER GROUP 718F-2
2. VHF/UHF RADIO SET . 718M-2
3. WILCOX - 807
4. AN/PRC-25/77

Used at DASC and TACP

### III. NAVIGATION EQUIPMENTS

#### A. IFF Equipments.

1. General Description. The system consists of airborne transponders, ground interrogator-receiver, processing equipment and an antenna system. The antenna may or may not be associated with, or slaved to, a primary surveillance radar. In operation, an interrogation pulse-group transmitted from the interrogator transmitter unit, via an antenna assembly, triggers each airborne transponder located in the direction of the main beam, causing a multiple pulse reply group to be transmitted from each transponder. These replies are received by the ground receiver and, after processing, are displayed to the controller. Measurement of the round-trip transit time determines the range (rho) to the replying aircraft while the mean direction of the main beam of the interrogator antenna, during the reply, de-



termines the azimuth (theta). The arrangement of the multiplepulse reply provides individualized pressure-altitude and identity information pertaining to the responding aircraft.

2. Interrogator Set AN/UPX-23.

Range Limitation - 0-200 miles

Deployment Areas - within TACS Scenario

Function - IFF Identification and position.

a. Transmitter.

RF Bandwidth - Capable of transmitting 0.5  $\mu$ second pulses with .1  $\mu$ second rise time, .15  $\mu$ second delay time.

Power Output - 2 KW (peak)

Antenna - Works with any L-Band IFF antenna (Vertical polarized)

Polarization - N/A

Gain - N/A

Sidelobe Structure - N/A

Beamwidth - N/A

Frequency Band - 1030  $\pm$  0.2 MHz (Crystal controlled)

Tunability - operates at 1030 only.

Modulation - Modes 1, 2, 3A or C including ISLS (internally generated).  
Can also handle Mode 4 externally generated pulses.

b. Receiver.

RF Bandwidth and Frequency - 1090 MHz  $\pm$  0.5 MHz.

IF Bandwidth and Frequency -

Bandwidth - 8 MHz at 3 db  
18 MHz at 40 db

Frequency - 60 MHz

Frequency Band - Operates at the 1090 MHz  $\pm$  .5 MHz IFF frequency only.

Receiver Sensitivity - 9 db Noise figure.

Dynamic Range

3. Airborne Receiver - Transmitter, AN/APX-64/APX-72.

Range Limitations - IFF Ranges - out to 200 miles

Deployment Areas - within TACS Scenario

Function - Provides IFF identification for aircraft in which transponder is installed.

a. Transmitter.

RF Bandwidth - Sufficient bandwidth to transmit 0.5  $\mu$ second pulses with .1  $\mu$ sec rise time and .2  $\mu$ sec decay time.

Power Output - 27 dbw at 1% duty cycle.

Antenna - Works with any omnidirectional IFF antenna (e. g. , AT-740/A airborne antenna).

Polarization - vertical

Gain - 1 to 3 db above isotropic

Beamwidth - Omnidirectional

Frequency Band - 1090 MHz  $\pm$  3 MHz (only).

Modulation - String of 0.5  $\mu$ sec pulses 1.45  $\mu$ sec apart, consisting of 14 pulses and/or string of 37 pulses 2  $\mu$ sec apart, for SIF and Mode 4 replies, respectively.

b. Receiver.

RF Bandwidth and Frequency - 1030 MHz  $\pm$  200 KHz

IF Bandwidth and Frequency -

IF Bandwidth - 7-9 MHz at 6 db from maximum response

IF Frequency - 60 MHz

Frequency Band - 10.0 MHz (only)

Receiver Sensitivity - -78 dbm minimum triggering level

Dynamic Range

## B. TACAN Equipments

1. General Description. Provides on-board display of air-derived slant range and azimuth of aircraft from a ground station which is identified by channel number and a Morse code identity signal.

a. Ground Subsystem: Provides DME response to airborne interrogations, and precise amplitude modulation of randomly spaced pulse transmissions (squitter) along with bearing reference pulse trains for airborne decoding to azimuth. The ground station receives no information regarding aircraft except average number of interrogations received. This information is not displayed.

### b. Airborne Subsystem:

(1) T/R Mode: . Receives and decodes/displays ground-radiated azimuth information.  
                  . Interrogates and receives/decodes/displays ground DME replies.  
                  . Receives and provides audio tone for ground station identification.

(2) Receive Mode: . Receives and decodes/displays ground station identification.

(3) Air/Air Mode: . Interrogates and receives DME replies from closest cooperating aircraft.  
                      . Provides DME replies to up to six strongest interrogations from cooperating aircraft.  
                      . Some airborne units are equipped to derive bearing information from suitably equipped aircraft.

## 2. Ground Station - AN/TRN-26.

### a. Transmitter.

Tuning Frequency - 962 - 1024 MHz  
                      1151 - 1213 MHz

Method of Tuning - Crystal synthesizer

Channeling Capability - 126 MHz in 1-MHz increments

Frequency Control - Crystal

Power Output - 400 watts

Pulse Rate - 7200 pps

Pulse Width - 3.5  $\mu$ sec

Rise Time - 2.5  $\mu$ sec

Fall Time - 2.5  $\mu$ sec

Emission Bandwidth - 250 KHz at -3 db  
700 KHz at -20db  
4 MHz at -60db

Occupied Bandwidth - 1 MHz

Harmonic Attenuation - 30 db

Spurious Attenuation - 50 db

Modulation or Coding - Pulse modulation (Class C) with 12  $\mu$ sec spacing pulse-to-pulse in a pair with 3600 pulse pairs/sec.

b. Receiver.

RF Bandwidth - 6 MHz -3 db  
50 MHz -20 db  
160 MHz -60 db

Tuning Range - 126 MHz in one (1) MHz increments

IF Bandwidth - 2.5 MHz (-3 db)

IF Frequency - 63 MHz

Sensitivity - -90 dbm

Image Response - -70 db

Spurious Response - -70 db

c. Antenna - Vertically stacked multi-element central radiator with rotating parasitic elements to effect modulation.



Polarization - Vertical

Gain - Transmit, +4.2 db  
Receive, +3.2 db

Beamwidth - AZ - Omnidirectional  
EL - 45°

Side Lobe - First null is typically 8 db down controlled by antenna height.

3. Airborne Station AN/ARN-21C

Range - 200 NM

Tuning Range - 126 MHz in 1-MHz increments

RF Frequency - 962 - 1024 MHz  
1151 - 1213 MHz

IF Frequency - 63 MHz

Image Response - -60 db

Sensitivity - -85 dbm

4. Future Airborne Transmitter - (1977 - 1980).

Tuning Frequency - 1025 - 1150 MHz

Method of Tuning - Frequency synthesizer

Channelling Capability - 1-MHz increments

Frequency Control - Crystal

Power Output - 1 KW

Pulse Rate - 94 pulse pairs search  
23 pulse pairs track  
24 - 1000 single pulse air-to-air

Pulse Width - 3.5  $\mu$ sec  $\pm$  0.5

Rise Time - 3  $\mu$ sec maximum

Fall Time - 3  $\mu$ sec maximum

Emission Bandwidth - 3 db - 275 KHz

Occupied Bandwidth - 750 KHz

Harmonic Attenuation - -60 db

Spurious Attenuation - -60 db

Pulse Coding - 12.0 sec for X Channel

36.0 sec for Y Channel

5. Future Airborne Receiver - (1977 - 1980)

Tuning Range - 962 - 1213 MHz in One (1) MHz increments

RF Frequency - 962 - 1213 MHz

IF Frequency - (1) 63 MHz

(2) 12.6 MHz

IF Bandwidth - 1.2 MHz -3 db

Sensitivity - -90 dbm

Image Response - -80 db

Spurious Response - -60 db (in band)

-80 db (outside band)

RF Bandwidth - Varies with frequency:

<u>For</u>	<u>962 MHz</u>	<u>1213 MHz</u>
-3 db	19 MHz	25 MHz
-20 db	37 MHz	55 MHz
-30 db	120 MHz	180 MHz

Airborne Antenna Characteristic - Sleeve Stub Type AT-741/A

Polarization - Vertical

Gain - +2 dbi

Beamwidth - AZ - 360°

EL - 45°

C. LORAN D Equipments.

1. General Description. LORAN D is a pulsed, low-frequency (LF), hyperbolic radio aid-to-navigation. It derives its high accuracy from time difference measurements of the pulsed carrier and the inherent stability of LF propagation. The wide coverage areas are made possible by the low propagation losses of LF ground-waves and the resultant long baseline lengths (station-to-station separation).

LORAN D is a tactical extension of LORAN C. The theory of operation is the same, but the physical size of the ground stations is reduced for mobility, sacrificing radiated power and coverage area.

Hyperbolic radio aids-to-navigation operate on the principle that the difference of time-of-arrival of signals from two stations, observed at a point in the coverage area, is a measure of the difference in distance from the point of observation to each of the stations. The locus of all points having the same observed difference in distance to a pair of stations is a hyperbola and is a line of position (LOP). The intersection of two or more LOP's defines the position of the observer. The accuracy of hyperbolic radio aids-to-navigation depends on the observer's ability to measure the difference between the times-of-arrival of two signals (time difference or TD) and his knowledge of the propagation conditions so that the time differences can be converted to LOP's.

Range Limitations - 500 to 800 nautical miles.

Deployment Areas - Worldwide

Function - Radio Navigation-aids

## 2. Transmitter.

RF Bandwidth - 5 KHz

Power Output - Present - 7 KW Peak (AN/TRN-36)  
Future - 30 KW Peak (AN/TRN-35)

Antenna Description - Polarization - Vertical

Gain - N/A

Sidelobe Structure - N/A

Beamwidth - Omnidirectional

The transmitting antenna is a top-loaded 400-foot vertical monopole tower.

Frequency Band - LF

Tunability - Fixed

Modulation - Pulse

3. **Receiver.**

RF Bandwidth - 5 KHz

RF Frequency - 100 KHz

IF Bandwidth - N/A

IF Frequency - N/A

Frequency Band - LF

Tunability - Fixed

Receiver Sensitivity - based on S/N = -10 db = 10 M Volts per meter

Dynamic Range - 80 db

Control over limiting - manufacture dependent.

All receivers have phase lock loops.

System Saturation Level - 80 db above minimum sensitivity.